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ABSTRACT

This nine-paper collection from a June 1983 Open University (OU) campus workshop in Milton Keynes, England, describes an interactive video project developed for an OU undergraduate course, T252, Introduction to Engineering Materials, and discusses varied aspects of interactive videodisc program development. The following papers are included: "Selecting Media and Possible Roles for Interactive Video in the Open University" (Tony Bates); "Interactive Videodiscs in America" (Dean Zollman); "Using Interactive Videodiscs in Open University Courses" (Bob Fuller); "T252 Videodisc, Its Origin and Aims" (Keith Williams); "Modes of Interaction with a Computer-Controlled Video System" (Paul Blenkhorn); "Organizing Material for an Interactive Videodisc" (Stephen Brown); and "Interactive Video Evaluation," "Evaluation of the T252 Videodisc," and "Questions for Discussion on Using Interactive Video in OU Courses," all by D. M. Laurillard. Appendices include a description of the videodisc lesson on material properties of metals and polymers, a content flowchart, a list of interactive video design tips, Philips videodisc mastering quotes, and the videodisc project proposal. (LMM)

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INTRODUCTION

The plans for the first interactive videodisc to be developed by The Open University for use in one of its undergraduate courses began in February when Keith, Stephen and I considered the "Blind Teddy Bear" television programme(T252/TV6) as an idea for a videodisc. Diana joined us to help with the preparation of our proposal to the Broadcast Subcommittee (Appendix A).

After our project was approved Paul Blenkhorn from Academic Computing and Martin Wright from the BBC were added to the videodisc development team. All of us spent much of April and May is finalizing the videodisc lesson plans.

We were ambitious in our goals, see the time schedule for our project, Appendix A, page 6. We were, in the last analysis, unable to meet the primary goal, to use the T252 videodisc in the summer schools for 1983. Nevertheless, the production of the master videotape and the computer software is well underway and we hope to have an interactive videodisc lesson for use before the end of 1983.

This booklet is a collection of papers we offered at a workshop on the campus in June, 1983. They provide some information about what we learned in working together on this videodisc project, as well as insights from Tony Bates and Dean Zollman.

I decided to make this booklet available quickly in this informal manner with its variety of styles, both in appearance and in content. I have chosen to add some appendices to the papers presented at the workshop to provide additional background information about this videodisc project as well as general information about videodisc mastering costs and hardware systems.

This project is only the beginning of the use of interactive videodiscs by the Open University. In a decade we may wonder how we ever got along without them. I hope this little booklet will encourage others to join in the exploration of the uses and values of interactive videodiscs.

Bob Fuller
June 30,1983

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Selecting Media and Possible Roles for Interactive Video in the Open University

by

Tony Bates

What is a video-disc?

A video-disc can store up to 57,500 single frames on one side, any of which can be identified and rapidly accessed, played back in any predetermined sequence, either singly or as motion pictures, over a range of speeds. Each disc has two simultaneous sound tracks, which can be used independently or together (to provide stereo sound, for instance). The disc can be controlled manually, or can be linked to a computer, which can "drive" the disc in a predetermined manner, providing interaction, branching and total learner control over the disc. The normal uninterrupted playing time for one side of an interactive video disc containing mainly moving pictures, is about 35 minutes, although one side of an interactive disc could easily occupy at least four or five hours study time. Discs are available at the moment in a play-back only form.

Different Formats

There are at least two different and incompatible formats for video discs:

CED. "Capacitance" video discs are electro-mechanically "read" by a stylus. These are the largest selling discs currently in the U.S.A., used primarily for feature films. However, they have poor still-frame facilities (the picture "switches" between two fields), and the stylus/disc contact leads to rapid wear and loss of picture. They are not yet interactive nor available on PAL standard, so are not of interest for OU purposes, at least for the moment.

Laservision. These discs are optically "read" by a laser. The disc never wears, and provides a very high-quality, stable still frame picture. There are two kinds available in Europe on PAL standard, both kinds of disc being playable on the other kind of laservision player:

a. Pioneer VD1100. This costs about £400. It has no inboard microcomputer, but it is possible to link it to a wide range of external micro-computers for little cost

b. Philips industrial model. This costs about £1200 and contains an inboard microcomputer which allows for individual frame and "chapter" (segment) identification and search. However, the interactive capability using the inboard microcomputer is limited, and it can be linked externally to only Philips own microcomputer.

Ways to Make Educational Video-Discs

a. Archive disc material. Archive material, either structured or unstructured, could be transferred to disc, with the student accessing as necessary.

b. Buy existing video-disc, and construct own computer program. This would mean purchasing a video-disc designed and produced elsewhere, then writing a computer program which controlled and accessed the disc and which included additional educational material on the computer program. For instance, the Apollo space discs contain colour film and photographs sent back by various space probes. A computer program could be written to structure or use such material as illustrations in a more general computer assisted learning programme.

c. Adapt existing television programme, and construct own computer program. An existing television programme can be re-edited, with perhaps some additional linking material, to fit together with a specially written computer program.

d. Design disc from scratch, with specially constructed computer program. In this case, the video material would be designed from the outset to be used in conjunction with a computer program. The design possibilities of such a format are limitless.

Why Use Video-Disc?

In selecting any teaching medium, the following factors have to be taken into account:

1. Overall objectives. What do you want to teach, how do you want to teach it (e.g. didactic or discovery) and to whom do you want to teach it?

2. Accessibility. How accessible is the medium for both teacher and learner? How can the teacher get learning materials to the learner? How easy is it for the teacher to use or design for such a medium? Will the learners be able to access easily such material? Where will the learner use it - home, a centre, summer school?

3. Teaching Functions. What special educational roles will each medium play? What can the chosen medium do better than other media?

4. Ease of production. How much time does it take for the teacher to design or produce materials in this medium? How much professional help will the teacher need? How easy will it be for the teacher to design the material himself or herself, or will it require a team effort?

5. Costs. How much does it cost to design and produce one hour's teaching material? How much does it cost to deliver? What does it cost the student, in terms of equipment, travelling or other costs?

6. Learners' Control. How easy is it for the learner to control the medium? Does the medium allow for interaction and feedback? Is it a "friendly" medium - will it be easy for the learner to use?

We have to look at each of these factors with regard to video-disc, to see where video-discs are likely to have advantages over other media.

Accessibility. There are two aspects here: access to microcomputers, and access to video-disc machines.

Microcomputers. The table below sets out OU students' access to microcomputers in November 1982. The figures are from an AVMRG survey carried out by Hans Grundin.

Table 1. Access to Micros: OU Students

Any type	Home	Elsewhere	Overall
All students	15%	19%	34%
Science students	19%	22%	41%
Technology students	25%	24%	49%
Maths students	26%	32%	58%
Specific type			
Sinclair	7%	2%	9%
PET/Apple	1%	4%	5%

Sample = 9454 students across 115 courses.

It can be seen that already, a third of OU students have access suitable for study purposes to microcomputers - in a special area like Maths, over half the students have convenient access, and this figure is likely to increase further and rapidly. However, very few students have access to the same kind of machine. Thus, computer software will have to be produced in a wide variety of formats.

Video-Discs. At the moment, less than 1% of homes in Britain have a video-disc machine. However, they came on the market only six months ago. In the USA last year, video-discs outsold pre-recorded cassettes. The video-cassette market penetration though is less in the USA than in Britain. While video-disc machines are likely to become more common in British homes over the next few years, it will take many years, if ever, before even 50%

of British homes have a video-disc machine. Nevertheless, they are not an excessively high-cost delivery technology, and could be provided at selected centres, secondary schools or summer schools; it is also possible that large companies will purchase video-disc machines for training purposes (a point I will return to later).

Teaching Functions

The main attraction of interactive video-discs is their ability to combine the teaching functions unique to both television and computers. There is not space here to go into detail about the unique pedagogic features of different media, and this is in any case an ill-defined and contentious topic. I am aware therefore, that what follows is very much open to challenge, but here goes!

Media differ in the symbol systems they use to present and transmit knowledge. Microcomputers are limited to text, diagrams and simple animation - the more complex the symbol systems to be used, the more difficult and expensive it becomes to design the software. Computers also tend to favour the structuring of knowledge and learning in certain ways, tending towards convergent thinking or limited routes or methods of responding. However, within these limitations, they provide excellent opportunities for interaction, feedback and practice, allowing for mastery of learning, within certain prescribed limits.

Television, on the other hand, is a very rich medium in terms of the symbol systems it employs. As well as text, diagrams and simple animation, television can present high-definition colour pictures in natural motion, sounds, and real-time recording of events. Television tends to use complex structures. Because of the richness of the images and symbols presented continuously and in an uninterrupted manner, the viewer must select and interpret to make sense of the information presented to him or her. Because of the elaborate structures, symbolism and speed of presentation of television, each individual will interpret television differently. Television therefore tends to stimulate creative, divergent or idiosyncratic thinking.

In other words, computers and television tend to stimulate different types of thinking, and different learning skills. The hope, therefore, is that interactive video will combine both these features, thus making it a very powerful teaching medium. Whether or not this is so though needs to be determined empirically.

Ease of Production

There is no doubt that interactive video scores badly on this criterion. It is time-consuming and complex, and requires professional skills not only from subject experts, but from television producers and computer programmers. A team approach is essential. In particular, video-discs designed from scratch are extremely complex to design.

Costs

Costs depend very much on the way in which the interactive video is designed. Before discussing this though it is important to distinguish between internal costs, i.e. costs incurred for programmes within the OU Undergraduate programme, and external costs, i.e. costs that the OU would charge for discs made for external use.

The OU has contracted with the BBC to provide roughly 200 television programmes a year, within a fixed budget which covers overheads and staff costs for this level of production. A video-disc programme for use in the Undergraduate programme can be bid for from this resource in the same way as other television programmes. In this sense, production of the video component costs no more than any other programme, except that in the case of an interactive disc made from scratch, the BBC are likely to argue that this is equivalent in production terms to the production of three "normal" television programmes. While the 3-programme equivalent claim could be challenged, it is not disputed that such a programme would require more production than a single, "normal" TV production. In addition, of course, there is the cost of the computer programming, which if done by ACS for Undergraduate purposes, could be "costed" in much the same way as the TV programme component. However, there is one additional cost for internal production that must be found, and that is the cost of mastering

the disc and making copies. This is likely to be not less than £4000 and not more than £6000 per production, some or all of which could almost certainly be recovered from external sales (see Appendix D for mastering costs).

It is likely that a major use of video-discs will be for external use, (see "Different Uses for Video-Discs" below). In this case, it is important that a realistic cost is charged, and this will depend on the way the disc is designed. For external use, a distinction has to be made between total costs and marginal costs. For "normal" TV production, OE programmes are charged the marginal cost (around £8000 - £10,000), i.e. the actual costs to the OU/BBC of adding an extra programme to the 200 production load. The average total cost though of a "normal" TV programme, including overheads, is around £35,000, so if the extra programmes were to carry their full share of overheads, this is what should be charged. In this exercise, I assume marginal costs for external users, although when production increases beyond a certain point (around 260 programmes) there will be a step-increase as more staff, etc. have to be hired to cope with the extra work.

Method 1: Existing Disc + Computer Programme

Production:

Video	Nil
Computer program	£500
Academic time	1 week

Distribution:

	1 copy	200 copies
Video	£20-£80	£4,000-£16,000
Computer program	£10	£2,000

Average costs:

Per disc (200)		£62.50
Per broadcast TV programme (200 students):	marginal	£50.00
	total:	£175.00

Method 2: Adapt Existing TV Programme + Computer Programmes

Production:

	Total	Marginal
Video-disc	£10,000-£35,000	£6,000-£10,000
Computer program	£2,000- £4,000	£2,000- £4,000
Academic time	£2,500	8 weeks

Distribution:

	1 copy	200 copies
Video-disc (min of 10)	£2,300	£4,100
Computer program	£10	£2,000

Average costs:

	Total	Marginal
Per disc (200)	£108	£85.50
Per broadcast TV programme (200 students)	£175	£50.00
Plus cost of existing programme per disc	£280	£135.00

Method 3: New Video-Disc + Computer Program

Production:	Total	Marginal
Video-disc	£70,000-£100,000	£30,000
Computer program	£7,000- £10,000	£7,000-£10,000
Academic time	£6,500	18 weeks

Distribution:	1 copy	200 copies
Video-disc	£2,300	£4,100
Computer program	£10	£2,000

Average costs:	Total	Marginal
Per disc (200)	£480	£220
Per broadcast TV programme (200) students)	£175	£50

These figures are of course crude, and certainly are unofficial, in that they do not represent actual BBC costings, although assumptions are based on actual experience. The aim is to give ball-park figures. The first two methods are relatively inexpensive in terms of resource, both in terms of marginal and total costs. For instance, the total cost for a method 2 disc is around £25,000. However, the third method is extremely expensive, given the BBC assumption that an interactive video-disc is equivalent to three programme productions. This would make the total production cost around £100,000, with 200 discs costing around £500 each. North American experience is rather different. The Tacoma Narrows Bridge disc (fully interactive video designed from scratch) cost around £40,000 ($60,000), including academic costs, to make, with discs marketed by John Wiley and Co. at £75 ($125) each.

The method 2 costs are deceptive, because they are based on an existing programme. This has already been paid for, although there may be rights and fees to be negotiated on the existing programme. If the full cost of making the original programme was added, this would increase the total cost per disc

to £280 and the marginal cost to £135, still considerably cheaper than making a new disc from scratch. However, a video-disc for internal OU use using an existing OU programme would not incur such additional costs, other than rights clearance.

Costs are a complex issue in the OU context. From an undergraduate course team's point of view, the main cost will be the £4000 to £6000 mastering and disc making costs over and above the programme allocation, plus additional support from ACS, and a heavy demand on academic time. From a CE point of view, costs are likely to be around £25,000-£50,000 for a disc based on existing programmes, and £70,000 to £100,000 for a newly-made disc, if BBC/OUP is used.

Learner Control

This is perhaps the main advantage of interactive video-disc. Provided that they can access the equipment, students have complete control over the learning process, they can review, replay and search until mastery is achieved, alternative "routes" can be built in according to the level or competance of the student, and each video segment can be viewed frame by frame if necessary.

Where Could Video-Discs be Used for Open University Purposes?

It is unlikely that discs can be used in homes for the next five or even 10 years, without requiring large numbers of students to rent or buy machines. Summer School however is a realistic proposition. Students can use interactive video-discs in exactly the way they already use CAL at Summer School. The equipment can stand extensive use. allowing large numbers of students to access the equipment in a short time.

Video discs - although relatively short in playing time - can occupy a considerable amount of study time. A whole complicated process can be condensed very briefly on a disc, and if students are to achieve mastery

many repeated playings and alternative decision-making will be necessary. This feature lends itself to short CE courses built around several day meetings. Discussions have taken place about the possibility of using video-discs on a "Computer in Architecture" course; video-discs may have potential for other courses with a similar structure, especially where skills are to be mastered.

Another possible location for video-discs would be for "single-users". Despite the high cost of designing a video-disc, this can be justified if alternative training methods are even more expensive or difficult to design. For instance, training oil-rig workers in emergency procedures cannot easily be done on site, without high costs in training and risks to actual production. Similarly, training nuclear power station operators for certain emergency procedures cannot be done on site; the emergency has to be simulated.

What Functions for Video-Discs?

Because of the branching capabilities of interactive video-discs, they can be used for teaching at different levels. The video-materials can remain the same, but the computer soft-ware can take students at different levels through different routes, or through different sound-tracks.

Interactive Video-Discs are also excellent for mastering procedures or learning skills. The requisite procedure for landing a light aircraft can be condensed into five minutes of video. The student can then be "put in the cockpit", given readings and an approach run, and instructed to make the necessary adjustments on the computer. The computer calculates the effects of the adjustements, then winds on to the appropriate part of the disc to show the consequence of the decision. This was the basis for a video-disc designed by the University of Nebraska. It is a short step from here to simulating conditions for training procedures.

Perhaps the most exciting use is yet to be fully explored. This is the potential of interactive video as a data-base. The Apollo space discs present material in a relatively unstructured way; linked with a computer

a researcher can be assessed on his or her ability to interpret and draw conclusions from the data. Expert procedures such as diagnosis and post-graduate research skills can be developed and tested through such interactive video-discs.

The Role of the Open University

The OU is uniquely placed to meet the challenge and potential of interactive video-disc production. It already has the experience and the structures for a team approach to disc design. It contains on one campus highly-skilled, professional broadcasters, broadcast equipment of the very high standard required for disc production, an Academic Computing Service with extensive experience in computer assisted learning, subject matter experts with experience of using media and evaluators and researchers with experience in formative evaluation procedures and in assessing the strengths and weaknesses of different instructional media.

There will certainly be opportunities and situations where video-discs can be used to enhance considerably the teaching of undergraduate courses. But the main potential of video discs lies in high-level industrial training, and consequently the opportunities in the Continuing Education area are immense, if only they can be grasped.

IN

AMERICA

Prepared by
Dean Zollman
Kansas State University

College level instruction

**Science

The Puzzle of the Tacoma Narrows Bridge Collapse (John Wiley and Sons, 605 Third Ave, New York, NY 10158)

Physics and Automoblie Collisions (Dean Zollman, Department of Physics, Kansas State University, Manhattan, KS 66506)

Interactive Science Series (Nebraska Videodisc Design/Production Group, Nebraska Educational Television, Lincoln, NE 68501)

SpaceDisc Series (Video Vision, 7 Waverly Place, Madison NJ 07940)

The Development of Living Things (WICAT Educational Foundation, 1875 S. State Street, Orem, UT 84057)

**Medicine

Hematology Slide Bank and Medical Application Series (John Bolles, Health Sciences Learning Resources Center, University of Washington, Seattle, WA 98195)

Miles Learning Center Series (Fusion Media, 8 West 95th Street, New York, NY 10025)

Medical Awareness Series (Jane Parker, Department of HRS, 1317 Winewood Blvd., Tallahassee, FL 32301)

**Law

Evidence Objections (Roger Kirst, College of Law, Univeristy of Nebraska, Lincoln, NE 68583)

**Social sciences

Introduction to Economics (Special Projects Office, Minnesota Educational Computing Consortium, 2520 broadway Drive, St. Paul, MN 55113)

**Languages

Spanish Instruction (Spanish Department, Brigham Young University, Provo, UT 84602)

**Fine Arts

Art and Dance Appreciation (Joan Sustik, Weeg Computing Center, University of Iowa, Iowa City, IA 52242)

**Handicapped Education

Sign Language (Instruction Technology Unit, ACCESS Alberta, 16930-114 Avenue, Edmonton , Alberta T5M 9Z9)

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Pre-college Education

Videodiscs for educating students who are below the college level have been developed by

Center for the Hearing Impaired
University of Nebraska
Lincoln, NE 68588

School of Graduate Studies and Exceptional Child Center
Utah State University
Logan, UT 84321

Videodisc Project
Simon Fraser University
Burnaby, B.C. V5A 1S6

Instructional Systems Program
Pennsylvania State University
University Park, PA 16802

Florida State University
Tallahassee, FL 32306

National Geographic Society
17th and M Streets
Washington, DC 20036

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Consumer Interactive Discs

Interactive videodiscs for the mass consumer market are being produced and sold by

Optical Programming Associates
445 Park Avenue
New York, NY 10022
(The First National Kidisc, How to Watch Professional Football, Fun and Games, Jazzercise, etc.)

VIDMAX
36 East Fourth Street
Cincinnati, OH 45202
(Mystery Disc Series, National Art Gallery tour)

INMAN Productions
8425 N. Merdian Street
Indianapolis, IN 46260
(How to Cope with ..., Developing Financial Strategies, etc.)

Using Interactive Videodiscs In OU Courses

by

Bob Fuller

Questions to consider:

* Does the content you intend to teach lend itself to an audio-visual presentation through a television monitor?

* Do you want to give the students control of their interactions with the presentation?

* Is an interactive videodisc the best medium for your presentation?
  Interactive- use the features of computer assisted learning
  Videodisc-a durable no-wear medium which holds 57,500 single pictures which can be addressed in a variety of ways, i.e. at random, in normal or slow motion, forward or backward, or as single pictures. The pictures can be accompanied by a high fidelity, two channel sound track.

* Can the use of the videodisc be fit into the OU structure of your course?
  1983-85-summer schools, day schools, continuing education
  1986-88-regional centres, public libraries, schools
  1989-offices and homes

If your answer to ALL of these questions is yes, then

you need to--

1) Organise an interactive videodisc development team.

2) Develop a proposal to secure required development, disc mastering, and equipment support.

3) Do it, test it, and tell about it.

T252 Videodisc, Its Origin and Aims

by

Keith Williams

T252, Introduction to Engineering Materials sets out to explain the why and how of the materials used to make things using case studies of commonplace articles, such as hacksaw blades, bicycle frames, safety spectacles and reinforced concrete schools to illustrate the relevance of its teaching. It is a second generation, ½ credit course with a Summer School at which over the past 2 years a set of computer aided learning tutorials has proved particularly popular and effective. They provide, in effect, a tireless tutor around the clock to tackle some of the conceptually difficult parts of the course. I see the initial developments of videodiscs as an expansion of this current effort.

The disc we are producing could be crudely described as a 'cut and stick' job of an existing TV programme. This broadcast programme was designed as a revision programme to trigger students memories of various aspects of materials behaviour and testing developed in the course. It is presented as a court room drama of the litigation surrounding the failure of a batch of Teddy Bear eyes. The story line is littered with nucleating points for revision tutorials.

This approach of cannibalisation has provided us with a rapid route to a disc, perhaps not so much in cutting down the physical effort of filming and so on, but in providing a skeleton around which a somewhat disparate group could work. The selection of the programme enabled

us to concentrate on how the system was going to work rather than on defining the content.

We saw our task as one of devising a way in which the user could participate in the trials and either ask questions or provide answers. Expediency dictated that the disc system asks the questions, the student provides the answers.

The structure we have evolved is one which asks the student to play the role of an expert witness. The video introduces the problem, the student then tackles an investigation that may include taking measurements and experimental results from the screen and is routed through remedial tutorials till the correct answer is produced. The video is then used to provide reinforcement of teaching by showing 'the real expert witness' present the evidence.

At present we are still working on the project so there is uncertainty as to the final success. Our rote of cannibalisation has ensured that we have not had disputes on academic level and content, the combined course team and A.C.S. experience of C.A.L. in the subject area gives us confidence that students will accept the system. Both the OU and BBC participants have had to explore more closely than previously the integration of textual teaching and visual image as computer text and video interleave and the 'conventional' two way academic-producer dialogue is replaced by a three way academic-producer-programmer interaction.

We have viewed the project as an experiment and have included as many varieties of student/system interractions as we have had space for. We don't have recipe to pass on and would not like our approach to become the institutional way of producing discs. We do, however, want to share our experience with any other groups who may wish to attempt a similar project.

Modes of Interaction with a Computer-controlled Video System

by

Paul Blenkhorn

Computer-controlled video enables kinds of interaction which are not possible with either a computer or video disc (or tape) separately. The present state of the art is, to say the least, somewhat crude and it would take a brave person to attempt to define the rules. Not being such a person, I shall describe some of the systems currently available, and give some examples of the applications of the systems.

Available systems

For all computer-controlled video systems (with only one player) there are a common group of capabilities which are available for controlling the video player. Basically, the computer can cause the video player to execute any of the commands available from the player's remote control pad. These can include still frame, normal play, fast play and slow motion (both in the forward and reverse directions). However, the audio soundtracks (in general two channels are available) can only be played in the normal forward play mode.

There are also, though, two extra facilities available which are not common to all systems and can thus be used to classify the current interactive video systems.

These are :-

i) The number of screens available (one or two).

This simply involves the capability either to use a single screen for displaying the images generated by the computer and/or the video player or to use a separate screen for each.

The Teddy Bears System will use a single screen.

ii) The overlay facility.

A VERY useful capability (if you can find a suitable system with it) is that of being able to overlay the text and graphics generated by the computer on the images produced by the video player.

The Teddy Bears system does not, at present, have an overlay facility.

Some examples

The following list of examples is by no means comprehensive and is intended to merely whet your appetite.

i) The video player can be used to present a selected sequence of video material.

E.g. an extract from the trial is shown at the start of the Teddy Bears Disc to hook and motivate the students.

ii) The video player can be used to present questions and appropriate feedback to the students' answers to the question.

E.g. Ask which of a set of lines on a graph represents the material with highest tensile strength.

iii) The student can 'drive' a piece of video.

E.g. By using the '>' key the student can apply an increasing load to a specimen in a tensile testing machine. After each keypress the computer instructs the video player to play the sequence of video corresponding to the increased load.

iv) The student can interrupt the video sequence.

E.g. The student is instructed to 'Press the <RETURN> key' when the U.T.S. is reached. The video is then played and, depending upon the student's performance, appropriate action is taken.

v) The student can interact with a simulation which decides upon the video image(s) to be displayed.

E.g. The student is allowed to vary a set of parameters for an experiment. The computer decides upon the consequence of these actions and displays the appropriate image. A concrete example would be of the student varying the environment in which a colony of flies were living. Given that the video consists of a sequence of frames in which the size of the population varies, then the computer could decide on whether to move forwards or backwards through the video (and could also control the speed of play).

This mode of interaction is not, at present, used in the Teddy bears disc.

vi) The student can be presented with the same video sequence, but with a selected audio track(s).
As there are two audio channels for each portion of video the same sequence can be played with either (or both) of the channels.

E.g. A sequence of video which shows a selection of teddy bear eyes has soundtracks which
a) describe where the eyes have come from
and b) explain in more detail the relevent features of the eyes.

Organising Material for an Interactive Videodisc

by

Stephen Brown

These notes are based on the experience of developing the T252 videodisc on materials science. They are intended to help other people about to produce their first videodisc but they are not meant as a definitive guide. Instead they consist of a brief description of how we organised our material plus comments and suggestions.

The notes are in three sections corresponding to two distinct phases in the project: planning and development plus general comments at the end.

1. Planning

- Identify the topic

  In fact we began by reviewing available television programmes to find material suitable for conversion to videodisc.

- Identify desired learning goals

  Learning can be broadly classified into three categories: knowledge, understanding and skills, where knowledge is the acquisition of information, understanding is the ability to think things out and skills involve being able to do things, physically or mentally. Specification of learning goals therefore necessarily entails specifying what kind of learning is expected to take place as well as what the learning content will be. In our case the learning content was mainly the mechanical properties of materials.

  The kind of learning we aimed for primarily was at the level of understanding. That is, we assumed that students would already be familiar with the factual content from their previous study. We wanted to give them an opportunity to apply their knowledge in ways which would test their understanding. This decision determined the overall tone of our disc, namely that it would be a student centred, investigative problem solving exercise.

- Review available materials

  We decided to use available material wherever possible in order to minimise the production time required. This policy had two advantageous spin-offs.

  It provided us with a ready made structure (the narrative of the trial).

  It minimised decision making about what should be included and how it should be presented. Decisions were influenced by what was available.

  It later became apparent that this policy was unnecessarily restrictive and some readily available video material was rejected in favour of new video designed to meet our exact needs.

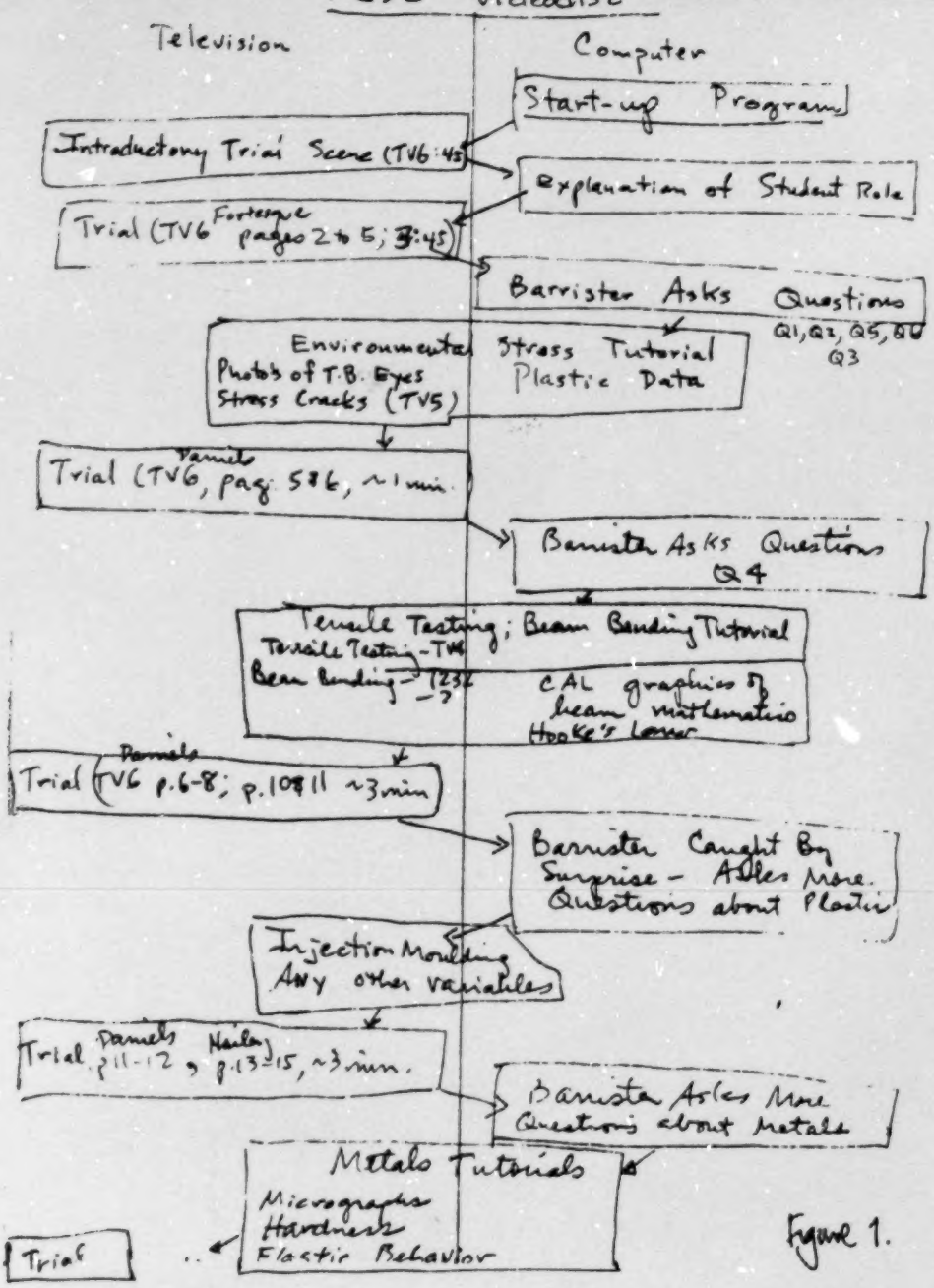

Figure 1.

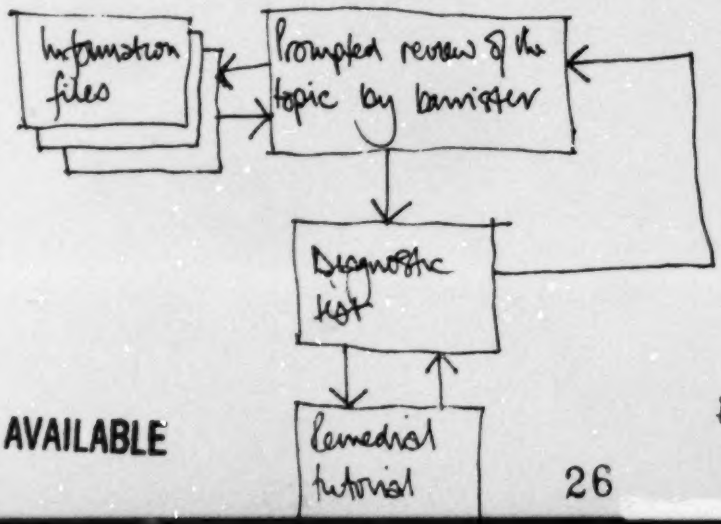

Figure 2

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- Generate outline conceptual map of the disc

Our first attempt is shown in figure 1. Points to note are:

1. The linearity, determined by the narrative structure of the trial on which it was based. Had we not been using a ready made film of the trial we could have made the structure more parallel and provided several different outcomes.

2. The division into video and computer made possible at this early stage by the use of existing material. Entirely new sections, i.e. the tutorials are not differentiated this way.

3. The four distinct functional components in the plan i.e.:

   - the introductory trial scene (used as a motivator)
   - the explanation of the student role to establish appropriate student learning behaviour
   - the trial sequences (used as narrative links to reinforce student learning and to maintain interest)
   - the barrister's questions and tutorial sequences to pose the problem in manageable chunks and, where necessary, provide remedial help.

N.B. This map was only a first draft and it was redefined, and elaborated as the project developed.

2. Development

- Familiarisation

If not already familiar with CAL and videodisc presentation techniques it would be a good idea at this stage to look at examples.

- Detailed development of components of the conceptual map

The main task was to develop the tutorial sections. They were treated as independent units and developed in parallel. The tutorial on 'The properties of washers' is used as an example here.

- Identifying learning objectives

These were identified on the basis of what students would need to know in order to tackle the question arising in the trial: "could a change in the metal washers have caused the cracks in the plastic eyes?"

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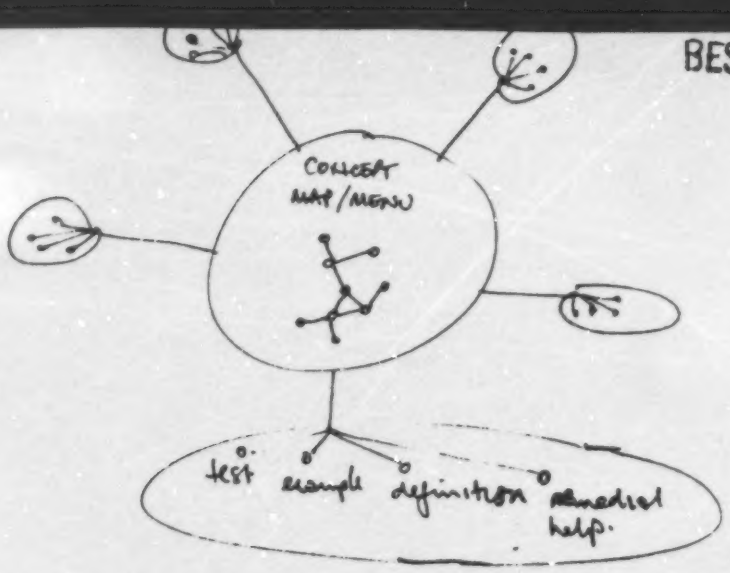
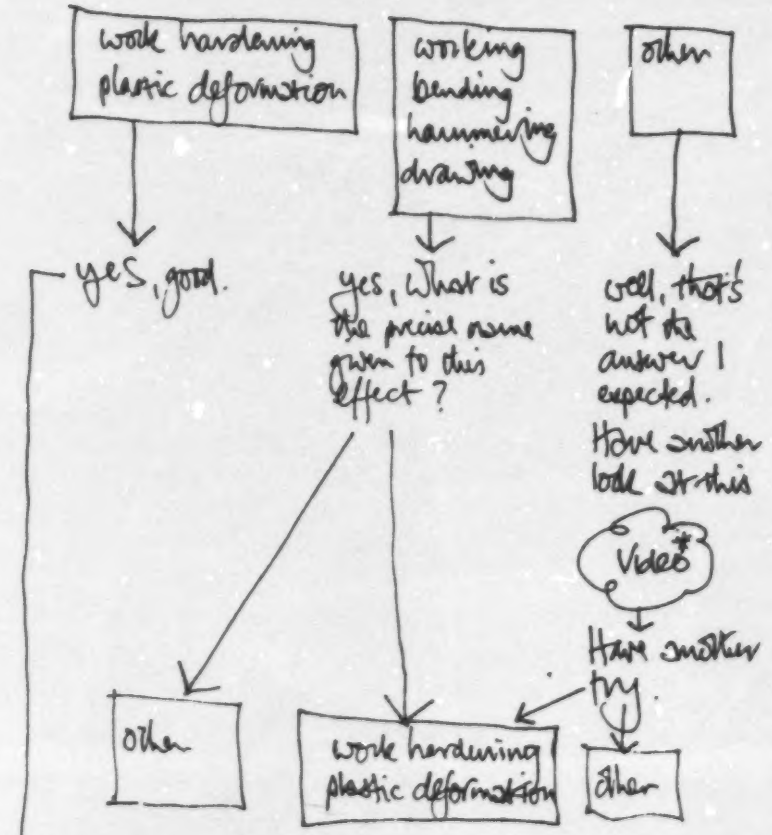


Figure 3

How can the yield stress of a material be raised?



Working the material so that it is deformed plastically increases the yield strength and the effect is known as work hardening.

Figure 4

- Devise a conceptual map

  In this case the tutorial was envisaged originally as a three level structure as shown in figure 2. The alternative star structure shown in figure 3 was suggested later.

- Elaborate conceptual map

  Language chosen in this case was a crude flow chart (figure 4). At a later stage this was converted to a story board for video production, which emphasised the video aspects and left the CAL sections blank (figure 5) and to CAL sheets which concentrated on precise CAL formulations and which left the video sequences blank where they were unaffected by the CAL (figure 6).

  Some general tips on how to design interactive videodisc learning materials are given in appendix C. In addition the following thought may be useful. Interactive videodiscs offer a unique opportunity to involve the student in the learning activity. They can get hands on experience of operating equipment (e.g. the tensile testing machine) or of observing processes (e.g. environmental stress cracking) testing ideas (e.g. simple tests for differences between the washers) gathering data (e.g. the Vicker's test) modelling ideas and performing calculations (e.g. the bending beam tutorial) and so on. Discs which exploit this unique property are likely to be highly successful teaching packages.

3. General comments

The preceding notes imply a simple linear development sequence. As with other course materials the development of the T252 disc has been iterative as ideas were developed, modified, rejected, etc.

- Developing a disc is necessarily a team effort

  Functionally four distinct roles are involved:

  - subject specialist
  - video producer
  - CAL programmer
  - instructional designer

  A team may involve more or less than four people but in the OU it will certainly be more than one.

  Since the essence of an interactive videodisc is the integration between video and CAL it is essential that all members of the team be involved right from the start and that all members should work together throughout the project. If some members join the team after the planning phase there can be wasteful duplication of ideas and replication of discussion, there can also be mis-

M

LAST FRAME OF 3J AGAIN
PLUS
CAPTION 80
'WHICH IS THE STRONGEST?'
PRESS 1, 2 OR 3

AUDIO TRACK ONE
Which material is the strongest? Is it either of the two steels or the bronze?

As before just key in your answer.

AUDIO TRACK TWO
No, the bronze isnt the strongest.

CAPTION 80A
S/I
NO, THE STRONGEST MATERIAL IS THE ONE WITH THE GREATEST ULTIMATE TENSILE STRENGTH

PRESS RETURN

No, the anneales steel isn't the strongest.

The strongest material is the one with the greatest ultimate tensile stress. Have another go. Which material is the strongest?

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Figure 5

PROJECT: T252

VIDEODISC PRODUCTION SHEET

Title:

Fig 6.

COMPUTER DISPLAY AND ROUTING

Unit# A-1

Screen Display: How can the yield stress of a material be raised?

WORDS TO MATCH	R/W/H	RESPONSE	ROUTING
work hardening plastic deformation	R	Yes, good. working the material so that it is deformed plastically increases the yield strength and the effect is known as work hardening.	B-1
working, bending hammering drawing	R	yes, what is the process name given to this effect?	A-2
HELP	W	Well, have another look at this	VIDEO/A1
(OTHERS)	W	Well that's not the answer I expected, have another look at this.	VIDEO/A1
2nd TIME NOT RIGHT	W/H	Well, working the material so that it is deformed plastically increases the yield strength and the effect is known as work hardening.	B-1

Notes:

Figure 6

understandings and unprofitable attachment to particular ideas which are not unanimously accepted. These problems can be exacerbated by poor communications among project group members.

This in fact constitutes a major challenge for OU teams wishing to produce videodiscs in the OU. Different production phases and areas are fairly clearly differentiated and the property of distinct professional experts. Thus for instance television production is the responsibility of the BBC and decisions about how exactly to film and edit material is the province of the producer. But the integrated nature of videodiscs means that such decisions cannot be made without reference to the requirements of the rest of the package. For example, in the case of the properties of washer's tutorial detailed decisions about how questions, hints and answers would be presented to students on video were determined largely by the constraints of the disc player and the flexibility of the programming. It was necessary for the instructional designer to modify his teaching strategy and for the producer to accept filming and editing instructions to take account of these constraints.

Working across professional and organisation boundaries and accepting the legitimacy of active participation by all team members in all stages of development may turn out to be the most difficult aspect of producing interactive videodiscs at the OU.

Interactive Video Evaluation

by

D.M. Laurillard

There are two interesting aspects of students use of the medium which the evaluation will have to look at: one is the nature of the medium itself - what it is like to learn from - and the second is the nature of the learning activity it is capable of encouraging in the students.

It is an unfamiliar medium, combining two slightly less unfamiliar media: TV and CAL. It requires the student to be sometimes active: making decisions, choosing options, calculating inputs; sometimes relatively passive: following a filmed experiment or event etc. It gives the student a degree of control over the resources available, giving them access to a wide variety of information in both slides and motion sequences. And it also controls the student, checking the input they give, giving feedback, routing them through different sections depending on their answers. The output they will get will vary between film plus audio, still frame alone, computer output plus audio, computer output alone; graphical, verbal, numerical information in iconic, enactive, symbolic forms - almost the whole range communication. This is its power. It is also potentially a source of confusion for the student. Students have a variety of more or less appropriate expectations of any learning task they come to. Some will expect this high technology black box to tell them everything. Others will expect it to be rather like programming a computer, where they can do what they like when they like. The first type will be asking 'what am I supposed to do now', the second type will continually be complaining 'why won't they let me do X?' Finding the right balance between guiding the student and giving them freedom is especially difficult with such a medium because there is so much scope for both. The evaluation will mount as observation study of students using the medium, to try and establish what features of the design assist or hinder the students along these lines.

The second point of interest is the nature of the learning activity the medium induces. This could be fascinating because the medium combines two quite different modes of learning. CAL is very good at challenging the student towards the specifics of their subject, at rehearsing than in the procedural aspects of 'how to do it'. TV is good at giving the student a broader overview, at

encouraging them to attend to the interpretative aspects of 'what it means'. Both are essential for a full understanding, of course. So will bringing together these two different modes of learning, in one learning task, help the student to combine these two essential aspects of their understanding? The way this video disc works is to begin with the broad, general level of the problem, on video, and then takes the student successively through the different levels of specifity via the CAL tutorials. Armed with this detailed knowledge of the specifics they are then taken back to the next issue in the solution of the general problem. What the learning task is doing, therefore is conducting the student on a trip through a complex knowledge map (which in this case happens to be the properties of materials). At the end of the trip, all the aspects of that map should be complete for the student - both what Young's modulus means and what part it plays in the behaviour of a particular material.

As I have said, the student is sometimes controlled, and sometimes free to choose how they go through the (underlying) map. What we cannct be sure of is to what extent they maintain their orientation of where they are. The map, the knowledge structure, is not explicit, they cannot even easily build a map for themselves as they do not have control over which bit they explore next. It is rather like going on a mystery tour where every so often the guide will stop at a cross-roads and ask which you you want to go. But students are used to being controlled, to following someone else's route through material, and they may be able to cope. This is one issue. The other is whether it will help them to combine the procedural and interpretative aspects of their understanding and synthesise the two.

One question for course teams to consider, then is how far interactive video might be able to contribute to the way students interact with the material you are giving them. If there is a problem of how well students can cope with both specifics and generalities, of how well they can bring together both the doing of the subject, with what it means, the how and the why, then maybe an interactive video package could help them with this. That is what this video disc is attempting to do: to help students synthesise the specifics into a broader understanding. And that is what the evaluation will report on - how can the two media be brought together to enable the students to synthesise their understanding of a subject?

Evaluation of the T252 Videodisc

by

D.M. Laurillard

The evaluation will provide information on (1) the operating characteristics of this microcomputer/videodisc system. (2) the educational value of the lesson materials, and (3) the medium of interactive video. The methods used will include observation, computer monitoring of student inputs and feedback sheets.

These methods will be implemented in the following ways:

(i) Through observation and feedback sheets, we will establish how easy it was to operate the equipment and to use it under the conditions of a summer school option.

(ii) The primary objective of this lesson is to help students bring together their previous knowledge and combine this effectively to solve a complex problem. Their progression and achievement will be assessed by analysing their inputs on knowledge tests, calculations, selections of information, and decisions. These inputs will be collected automatically throughout the tutorial sessions and recorded in computer data files. The design of the lesson, which includes tests and remedial sections, will also enable us to establish what content is learned during the session. It is expected that group co-operation will lead to dialogues between students which will enable an observation study to describe the level of thinking and reasoning induced by the lesson. For example, what level of complexity of relational statements or hypotheses do the students employ to synthesise their knowledge.

(iii) The medium is different from any other currently used by students and will require careful observation to determine (a) whether students are able to access all the parts of the visual/graphical information they need, (b) how well they can work using the two outputs to the monitor, from computer and videodisc, (c) how the balance of control between student and program affects the way different students work at the various levels of difficulty in the lesson.

The observation study will be carried out during two weeks of summer school. The computer monitoring will continue throughout the four weeks of its use.

Evaluation findings will be written up as a report to the development team, the T 252 course team, the Broadcast Subcommittee and the MPAG.

Questions for Discussion on Using Interactive Video(IV) in OU Courses

by

D.M. Laurillard

Which are the problematic areas for students of your subject that could be assisted by the introduction of IV?

Which existing CAL can be enhanced by the addition of video?

What are the areas within your subject where students need the combination of interpretation and procedure that IV can provide?

Which subject areas could make use of a resource disc, e.g. a slide bank, or a combination of slides, text and motion picture?

In which cases could the audio plus CAL facility make a better alternative to cassette-vision packages?

How should a course team approach the use of new media such as this?

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MATERIAL PROPERTIES OF METALS AND POLYMERS

An Interactive Videodisc Lesson for T 252 Summer School

1983

INTRODUCTION

This lesson will present important concepts related to the material properties of metals and polymers in an interactive videodisc mode. The lesson will consist of a videodisc and related computer disks to be used in an interconnected microcomputer/videodisc player system. It is planned to make three such systems available in the T 252 summer school C.A.L. tutorial room.

This interactive videodisc lesson will lend itself to the self-service system of availability that we plan at summer school. The Materials discipline has offered C.A.L. packages at summer school for a number of years, with terminals available for student use adjacent to the residential rather than the laboratory block. Data logging of student responses has shown most extensive use after evening tutorial sessions. Direct observation has shown that students typically work in groups of two or three, effectively creating a self-help tutorial group around each terminal. We feel that we have sufficient experience and confidence in our existing C.A.L. system to undertake an experiment in the use of interactive videodisc technology without alteration to summer school arrangments or planning.

THE TARGET AUDIENCE

The interactive videodisc lesson will be designed as a component part of T 252 and thus its main target audience will be students in that course (approximately 320 per year).

In addition the lesson will have potential for use with several categories of secondary users:

*T 101 students at summer school- Structures and Materials is one of the most difficult areas in the revised version of T 101. The television programme which will serve as the basis for this videodisc lesson(T 252/TV6) has already been successfully used in T 101 tutorials by one of the development team members. The proposed lesson will be a valuable addition to the T 101 summer school(4500 students per year)

*T 353 students- The advanced exercises in the lesson would be suitable for use at T 353 day schools.

*Other Universities- The content of the proposed videodisc lesson will be comparable with the contents of materials science courses taught at other universities. It is likely that there will be considerable UK and overseas interest in such an interactive videodisc lesson.

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The MAIN level for most T 252 students is where they will act as brief for either one of the two barristers in the case. At this level they will be required to sift through technical evidence to provide the structure of the case to be presented. For example, students may be expected to select the three most relevant micrographs from a set of a dozen , or to process a set of tensile test data to generate the yield stress and modulus of a steel. Information at the students' disposal will be rated according to its utility, thus students' selections will be scored on the basis of their relevance to the trial.

Students who experience difficulty with this main level will be routed via diagnostic questions to a REMEDIAL level. At this level (which will also be appropriate for T 101 students) students will be asked to play the role of the judge in the trial. To arrive at a judgement they will need to have a basic grasp of the evidence presented. Test questions at strategic points will test their understanding of the concepts used and route them, as necessary, through remedial teaching sections of the lesson.

For the most capable students there will be an ADVANCED level (appropriate also for T 353 students) in which a student will be asked to play the role of one of the expert witnesses in the trial. They will need to use their knowledge of structures and materials to devise suitable tests for the specimens shown on the videodisc and to form appropriate hypotheses concerning the causes of failure. Students at this highest level will be able to carry out different materials tests vicariously through supplementary materials that uses laboratory sequences, computer generated graphics, and calculations. The various tests available will be rated according to their utility and student selection of tests will be scored on usefulness to the case.

Exceptional students will be given the opportunity to carry out a DESIGN EXERCISE on behalf of the defendant in the case . They will be asked to redesign the washers within given cost and performance constraints. The shape of the washer will be specified but students will be able to successively vary the dimensions, material, and manufacturing processes to arrive at an optimum solution. Student solutions will be stored and a "best solution so far" will be available for consultation by subsequent students.

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APPENDIX A

EVALUATION

The evaluation will provide information on (1) the operating characteristics of this microcomputer/videodisc system, (2) the educational value of the lesson materials, and (3) the medium of interactive video. The methods used will include observation, computer monitoring of student inputs, and feedback sheets.

These methods will be implemented in the following ways:

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(iii) The medium is different from any other currently used by students and will require careful observation to determine (a) whether students are able to access all the parts of the visual/graphical information they need, (b) how well they can work using the two outputs to the monitor(s), computer and videodisc, (c) how the balance of control between student and program affects the way different students work at the various levels of difficulty in the lesson.

Evaluation findings will be written up as a report to the development team, the T 252 course team, the Broadcast Subcommittee, and the MPAG.

Date submitted: March 2, 1983

Proposed by:

Keith Williams, Materials Science
Stephen Brown, IET and Technology
Robert Fuller, Consultant
Diana Laurillard, IET

Resources for T 252 Interactive Videodisc Production:

Already Available:

Development and Evaluation Team-
Keith Williams (Materials Science), Stephen Brown (Technology and IET), Robert Fuller (Consultant), and Diana Laurillard (IET).

Prototypical computer/videodisc system hardware

Additional Requirements:

Television Support-

The development team intends to use about 26 minutes of existing television material.

Eight minutes of additional television material will be needed, about half to be shot in the studio and half in the materials science laboratory. The disc will require about 1500 single frames including titles, single photos, micrographs, and computer generated text or graphics.

The construction of the master tape will require from 3 to 5 days of post-production editing.

This is estimated to be equivalent to one heavy studio production (B type) and will require about six weeks of full time help from a television producer.

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Computer Support-

The development team intends for the video material to be integrated into a computer assisted learning lesson. An appropriate data base management system will be used to help in the evaluation of the student use of the videodisc.

It is estimated to require about eight weeks of full time help from an academic computing service person.

Equipment Support-

Three student systems will be used from July 18 through August 12 at the T 252 summer school in Nottingham.

Estimated Financial Support-

Costs of videodisc mastering.....£2500
Evaluation costs.....£100
Equipment costs.....£2100 to £7200

(to use hired computers and purchase only videodisc players and the computer interfaces will cost about £2100, to purchase complete systems will cost about £7200.).....

MATERIALS PROPERTIES OF METALS AND POLYMERS
AnInteractive Videodisc Project for T 252

PROJECT SCHEDULE: As revised 4/3/83

Tasks	Target Date
Officially begin the project	March 7,1983
Final flow chart of the videodisc with a description of all television scenes and computer lessons. Begin evaluation design.	March 18,1983
Final decision about actual hardware systems to be used in the summer schools will be made by	April 8,1983
Final shooting scripts for all video sequences, including scenes taken from existing television programmes.	April 22,1983
All video and film source materials will have been shot by	May 15,1983
Evaluation design completed.	May 22,1983
Post-production work to prepare the videodisc master will be completed by	May 27,1983
+++++Mastering time for Pioneer or Phillips++++	(5 weeks)
Production of evaluation/feedback forms	June,1983
Completion of computer software	July 4,1983
Delivery of videodiscs to the OU for testing of videodiscs and computer programmes	July 4,1983
Beginning of T 252 Summer School	July 9,1983
Completion of evaluation report with recommendations	Nov. 1,1983

BIBLIOTECA T252

T 252 VIDEODISC PROJECT

(based on the television program "An Ey for An Eye", T 252/TV6)

Preliminary Flow Chart
(revised March 15,1983)

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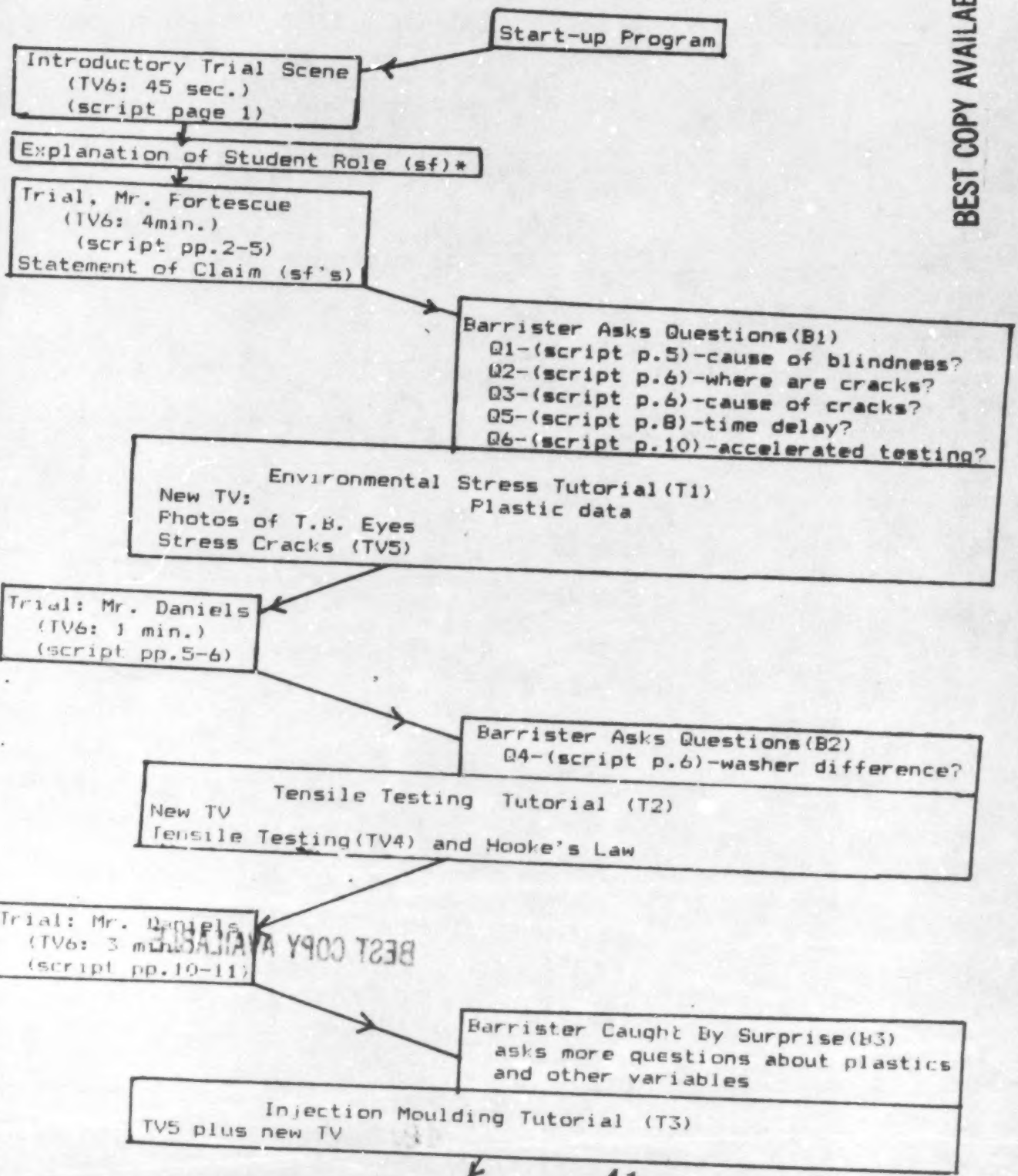

T 252 Videodisc Flowchart continued-

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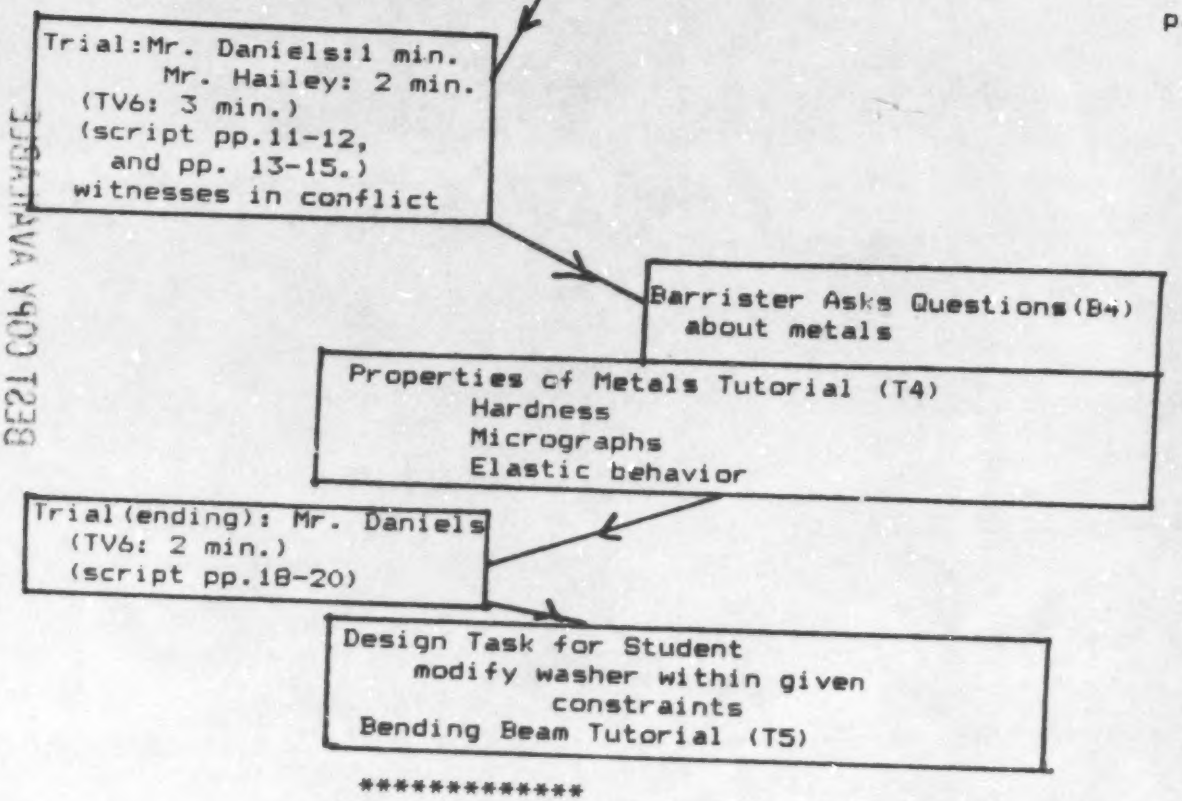

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Computer Key Words:

Help-give help appropriate to student location in the lesson
Stop-gives the section number and stops the lesson
Claim-gives the statement of Fortescue Furries claims
Info-goes to Fortescue Furries technical resources library
Menu-a table of contents..should it be available?

* (sf) means single video frame

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Taken from:

Handbook of Interactive Video
edited by S. and B. Floyd
Knowledge Pubs., 1982

INTERACTIVE VIDEO DESIGN TIPS

1) Think of how the typical user will perceive and react to the material. Make sure that he or she will be able to follow the logic. The material should not only be technically accurate but it should appeal to or stimulate the user as well.

2) Avoid negative or "punishing" answers to a user's response (a joke about a wrong answer may be taken the wrong way). Encourage or acknowledge the user positively, and correct any misconceptions as soon as possible.

3) Use the same techniques that work well in linear presentations:
   a) Motivate viewers by showing how they can use the material —why it is important and what the objectives are.
   b) Give an overview of the structure.
   c) Define major points and any unique abbreviations or acronyms.
   d) Use examples to support and highlight definitions.
   e) Process examples to clarify and reinforce key points.
   f) Tie the material together in a sub-summary before moving to the next major point or stopping for a test.

4) Make presentations visual and aesthetically pleasing. Avoid lengthy text displays or talking head explanations. Use symbols, color codes, numbers, titles and format consistently to reinforce continuity and to reduce the possibility for confusion.

5) Avoid true-false questions.

6) Apply "form follows function" to the design so that you always have a reason for an action. This gives the structure a logical direction and eliminates unnecessary branching or testing.

7) Make the technology as transparent as possible to the user—a standard already set by video games. Try to involve the user without using cumbersome peripherals, unnecessary testing, or long delays during a search. In other words, don't let the technology get in the way.

8) There is a definite learning curve effect in developing interactive programming. Early efforts may require two or three times the lead time and budget of later programs: so plan accordingly and don't become frustrated.

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PHILIPS VIDEODISC MASTERING QUOTES

May 12, 1983

No. of Copies	Copy Cost Total	Mastering Charges	Total Cost	Marginal Cost/disc	Ave. Cost/disc
10	£800	£1500	£2300	£230	£230
50	£1500	£1500	£3000	£17.5	£60
100	£2000	£1500	£3500	£10	£35
200	£2600	£1500	£4100	£6	£20.5
500	£4000	£1500	£5500	£4.67	£11
1000	£7500	£1500	£9000	£7	£9

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Proposal For 1983 OU Summer School

Interactive Videodisc System

Prepared for the consideration of the development teams

by Paul L. Blenkhorn A.C.S.

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1.0 INTRODUCTION

It has been proposed that a videodisc system will be used in the 1983 summer school for T232 (Engineering mechanics: solids) and T252 (Engineering materials: an introduction). The system will be used to present interactive CAL tutorials to the students.

This document describes

- the requirements for such an interactive videodisc system
- the constraints under which the system is to be developed
- the hardware and software currently available for the system

and proposes a system for use this summer.

2.0 REQUIREMENTS OF AN INTERACTIVE VIDEO SYSTEM.

To present an Interactive Video tutorial one must have resources for both the areas of videodisc production and CAL. The further essential requirement is for a device (interface) to enable these media to communicate with each other.

Thus, the three fundamental requirements are

- Videodisc and player
- Interface between computer and videodisc player
- Computer hardware and software

Although, at present, each of these requirements to some extent affects the other two I shall consider them separately here.

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2.1 Videodisc And Player

There are basically three features of a videodisc player which are of interest in deciding upon its suitability for an interactive tutorial.

a) The player can be controlled by an external device.
This is the essential requirement for interactive video using a computer to control the dialogue. It allows the computer to instruct the videodisc player to Play, Stop, Search etc..

b) The player can communicate it's status to the external device.
This feature allows the computer to 'know' the status of the videodisc player i.e. whether the player has executed the last command sent to it, the frame number of the present frame, etc.. Without this facility the computer cannot be sure of the status of the videodisc player and so may not know if an instruction has been carried out or if a sequence of video has finished.
If the player has the above facilities then it also means that the player can be instructed to PLAY FROM a starting frame TO a final frame. The PLAY TO (or AUTOSTOP) facility is very much to be desired as it enables sequences to be frame accurate.

c) The player may itself be programmable.
As a computer is to be used the programmability of the video player is not relevent.

2.2 Interface Between The Video And Computer

To use a computer and video player in conjunction there must be a 'black box' (and associated software on the computer) to interface between them. This interface may be classified as being at one of the following levels :

I) The computer can control the searching, playing, etc. of the video tape/disc machine. (This is the basic requirement.);

II) A level II interface has the capabilities of a level I interface plus ...
Displaying either video image or computer graphics/text on a single screen (although not both at the same time). Also the audio from the video player can be played whilst the computer's graphics/text are being displayed;

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III) A level III interface has the capabilities of a level II interface plus ...
Overlaying of the computer's text/graphics on the video player moving images.
NOTE: For this you need to synchronise the outputs from the video player and the computer - a non-trivial task in general. One way to do this is to synchronise the computer's video signal to the video player;

IV) A level IV interface has the capabilities of a level III interface plus ...
Overlaying of the computer's text/graphics over the video player still frame. It is my understanding that when a video player is displaying a still frame then the synchronisation is not constant (i.e. it goes haywire) thus making the synchronisation of the video player to an external source necessary.

Another feature which is available with some interfaces is the controlling of two video players (or a video player and a random access audio cassette) by one computer.

Note : the difference between level I and level II is basically whether one uses a single screen or two screens. There has been no research, as far as I know, as to which is better but I believe that the motion on one screen whilst the student is watching the other must be distracting, and so I recommend a single screen system.

2.3 Computer Hardware And Software

The use of the computer can be conveniently split into two components, hardware (i.e. the machine(s)) and the software (i.e. the program(s)).

2.3.1 Hardware -

There are four basic hardware requirements for the computer hardware for use with an interactive video system :

- The computer must be able able to communicate with the external devices i.e. videodisc player and/or interface;
- The computer must have sufficient memory to hold the necessary program(s);

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- The computer must have large enough disc drives to hold the program(s) and the data which will be collected for student evaluation;

- If the computer and the videodisc player are to share a screen then the video signal produced by the computer must be capable of being displayed on the same screen as that of the videodisc player.

Note : The video generator for the computer can communicate in several ways with the computer. Two of these are discussed below.

1) The generator directly accesses the computer's memory. This can enable the computer to rapidly change the image displayed on the screen.
An example of this is the APPLE microcomputer where the mapping of the screen takes up part of the APPLE'S memory.

2) The generator can be separate from the computer. In this case the generator and computer communicate via 'control codes' which tell the generator what to display. Although this can be somewhat slower than directly accessing the computer's memory it does means that the generator is separate from the computer and so, given compatable software (see below) the same generator can be used with different computers.
An example of this case is the GIGI graphics terminal which can be 'driven' by a range of computers.

2.3.2 Software -
In general the production of CAL tutorials is greatly facilitated by producing the tutorial using an authoring language. For an interactive videodisc tutorial this language should be

- able to control the videodisc player

- capable of being used to construct dialogues

- able to generate graphics easily

- portable between machines

Portability is to be desired for two reasons. Firstly, it is envisaged that the technology involved in videodisc presentation will soon have greatly improved. Thus transfer to a 'better' system is quite likely. Secondly, a well proven approach to software development is to develop on as powerful a machine as possible and then to deliver on whatever machine is available.

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3.0 CONSTRAINTS

As a result of the very nature of the project there are several constraints which apply.

The first of these is that the disc is to be produced in PAL format. At present there is limited hardware and software available for PAL videodisc systems.

Secondly, there are less than four months left before the system is to be ready for student useage. This means that there is virtually no time for experimentation with possible hardware configurations. Also there is very little time for system-software development before the task of coding the system must start.

A further point which must be born in mind is that the technology is developing so fast that a system developed this year should be as portable as possible so that the tutorial can be updated when further capabilities become available.

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4.0 POSSIBLE SYSTEMS.

For a PAL interactive videodisc system there are only two videodisc companies producing players (Philips and Pioneer) . I shall thus consider these separately.

4.1 Philips

Although Philips produce two videodisc players only one of these is suitable for use with a computer - the VP 705 Professional Player.

The Philips Professional Video Disc Player VP 705

- has the facilities (a) and (b) described in section 2.1. Note : I have been told that a player with all the facilities of section 2.1 will be available from Philips 'next year'.
- has the videodisc-computer interface built in.
- will overlay teletext text and graphics on the videodisc images. However, to do this a teletext television is required.

At present there is only one company producing the software to control the Philips player - by OWL Communications for use with an APPLE and a C.C.S. serial interface card.

Note : The software produced by OWL is in APPLE PASCAL and so the authoring system OASIS (see section 4.2.3 (b)) would be suitable.

There are two problems associated with the Philips player.

i) Although Philips have said that players will be available this may not not prove to be the case.

ii) The Philips player currently available is a prototype model which to be superseded by a player with all the capabilities of section 2.1. As a result Philips will not guarantee availability of parts after 6 months from the date of purchase for the VP 705

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4.2 Pioneer

The PAL Pioneer player is basically a carbon copy of the NTSC Pioneer Player, and so all of the U.S. interfaces for the NTSC player should work with the PAL version (we have done this with two of the U.S. interfaces).
There are therefore many interfaces which work with this player, but I shall consider just four possible interfaces.

Note : the Pioneer player only has feature (a) described in section 2.1.

4.2.1 Acorn's Interface For The BBC Micro. -

This interface allows the BBC micro to control the Pioneer player and has been demonstrated to several members of the interactive video group. However, I do not think that this is suitable for two reasons.

- the interface is not yet commercially available and although we may be able to obtain a version it would be better to wait until it has been `polished'
- the BBC micro itself is not really powerful enough, at present, to control a CAL tutorial of the type required. An alternative to this is to use the BBC micro as a terminal from a more powerful computer. Due to the constraints of time this is not feasible for 1983 but should be considered for future developments.

4.2.2 Allen Communications Universal Interface. -

This interface allows virtually any computer to control all of the videodisc players in the U.S. (which can be controlled) and hence the PAL Pioneer Player. It is of level II as described above in section 2.2 and if the video signals of the player and graphics generator are synchronised can support up to level IV (so I was told by Rex Allen but I have not seen this working). This interface also allows two players to be controled by the same computer.

At present there is not enough time to experiment with this interface for 1983, but I stongly recommend that one is bought for evaluation.

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4.2.3 Allen Communications VMI Interface And Omniscan Interface - These are level II interfaces for the APPLE II computer.
(Note : the VMI interface will support the same players as the universal interface described above.)

These two interfaces are both in use at the Open University controlling the Pioneer player.

The software associated with the Omniscan interface has only just arrived and so the evaluation as to which of these two interfaces is more appropriate for our uses will be made shortly.

I shall consider two possible authoring systems for use with these interfaces :

a) Use the language SUPERPILOT.
This is an authoring language which runs on an APPLE computer and can be used to control a videodisc player. However, portability must be considered and as the hardware may well change in the future I do not recommend SUPERPILOT.

b) Use Open University developed software.
There are several subroutines (collectively called OASIS) which have been developed in ACS by Ian Every for use with UCSD Pascal. These have been designed to be portable between different machines which use UCSD Pascal and should enable software written this year to be easily updated.

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5.0 PROPOSED SYSTEM(S)

There are thus two possible systems for use this summer

System 1

- Philips Professional Laservision Player (VP 705)
- APPLE II microcomputer with 2 disc drives and language card
- APPLE Pascal with OASIS
- C.C.S. serial interface card
- Teletext television

System 2

- Pioneer LD-1100 Player
- APPLE II microcomputer with 2 disc drives and language card
- APPLE Pascal with OASIS
- VMI or Omniscan interface card
  (decision to be made after evaluation of interfaces)
- Colour monitor

In deciding upon which system to choose the problems associated with the videodisc player in System 1 should be strongly considered.
(See section 4.1 (i) and (ii)).

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